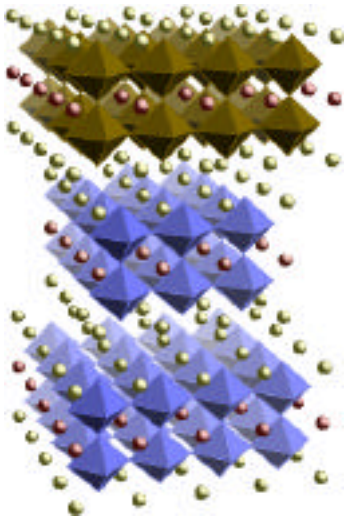
Full Bulk Spin Polarization and Intrinsic Tunnel Barriers at the Surface of Layered Manganites

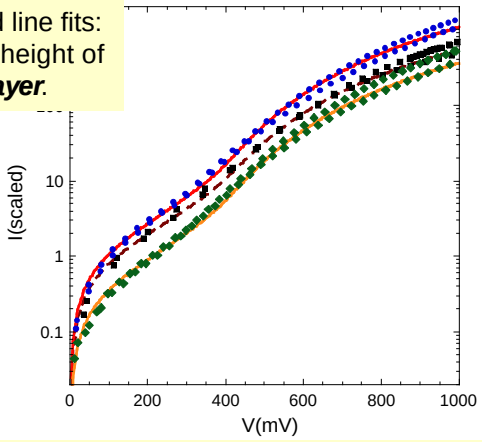
K.E. Gray, J.W. Freeland, L. Ozyuzer (Izmir Inst. Tech., Turkey), Elvira Badica, J. Kavich (Univ. Illinois, Chicago), H. Jennifer Zheng and J.F. Mitchell, *Nature Materials* **4**, 62 (2005).

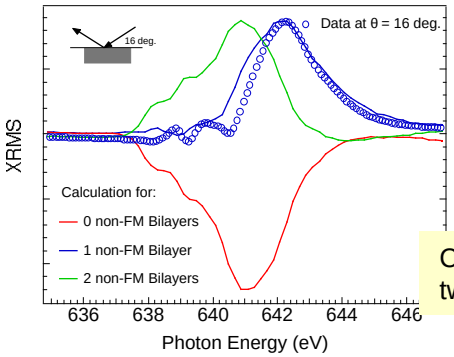
Insightful probes of bulk electronic properties, like photoemission and tunneling, are necessarily surface probes. To properly interpret them, any surface modifications must be understood.

What have we learned? In $La_{2-2x}Sr_{1+2x}Mn_2O_7$, the surface bilayer ***alone*** is an insulating, non-ferromagnetic nanoskin.



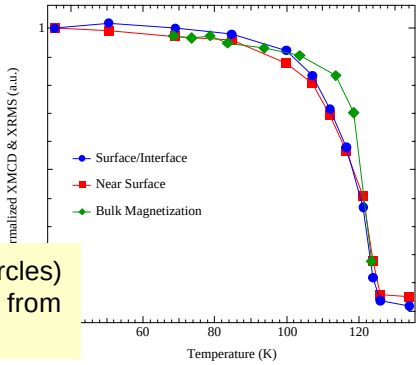
Tunneling data on layered manganite. Solid line fits: standard tunneling expression for a barrier height of 375 meV and width of 1.4 nm ***of a single bilayer***.





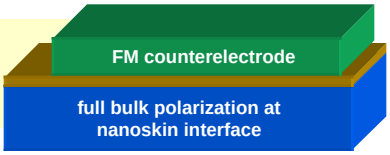
Calculated x-ray magnetic scattering at 16º for zero (red), one (blue) and two (green) non-FM bilayers. Data fits only ***a single non-FM bilayer***.

- Non-FM insulator is consistent with double exchange
- X-rays also show full spin alignment in 2nd bilayer up to ~T_C
- Tunneling evidence (inset) for mild pseudogap at E_F



Magnetization ***in the 2nd bilayer*** from x-ray magnetic scattering (blue circles) and x-ray magnetic circular dichroism (red squares). Slight deviations from the bulk magnetization (green diamonds) occur only very close to T_C.

Self-assembled nanoskins: A pathway to ideal magnetic tunnel junctions



Spin electronics processes information using electron spin as well as charge.

"The magnetic tunnel junction is emerging as a basic building block for spin electronics."

"A naturally self-assembled insulating layer on bilayer manganites provides a highly sensitive model system."

M. Coey "Thin skins for magnetic sensitivity", ***Nature Materials*** **4**, 9 (2005)